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MEDICAL SCIENCES

IMPACT OF THE PAIN MANAGEMENT IN THE COMPLEX REHABILITATION ALGORITHM OF ORTHOPEDIC AND TRAUMATIC CONDITIONS

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Abstract:

Pain management is an important part of rehabilitation algorithms in clinical rehabilitation practice, especially in patients with orthopedic and traumatic (OT) conditions. Current article presents the author's opinion about the necessity of structuration of complex rehabilitation algorithms (PRM programmes of care), including not only different natural and pre-formed physical modalities, but too a detailed functional evaluation at the beginning (baseline) and at the end of every rehab course – in all patients with orthopedic and traumatic conditions. Physical analgesia procedures, methods and mechanisms are included.

Keywords: pain, physical analgesia, physical medicine, rehabilitation, algorithm

1.INTRODUCTION

Pain management is an important part of rehabilitation algorithms in clinical rehabilitation practice, especially in patients with orthopedic and traumatic (OT) conditions. The Declaration of Montréal of the International Pain Summit of the International Association for the Study of Pain (IASP) identifies that chronic pain is a serious chronic health problem and access to pain management is a fundamental human right.

2.PAIN AND PHYSICAL ANALGESIA

2.1.PAIN [9, 13]

Pain is one of the most frequent sensations, formed in the nervous system, with different functional characteristics.

Pain is a subjective experience, provoked by nociceptive activation, by changes in sensory nerves and roads, or by cerebral centres – regulating of the stress, the affects and the motivation.

Different factors (physical, chemical, psychological) can influence on the pain perception.

According the definition of the International association for the study of pain (IASP) this is an unpleasant sensory and emotional experience associated with actual or potential tissue damage, or described in terms of such damage.

The *biological significance* of pain perception is the protection of the organism from negative external influences (*signal attention*).

There are different types of pain: *acute and chronic* (persistent); *nociceptive pain & neuropathic pain*; others (central pain).

In clinical rehabilitation practice, we use another differentiation of pain:

► In **Neurorehabilitation**: *nociceptive or neuropathic pain*;

► In **Rheumatologic patients**: *pain in degenerative joint diseases; and in inflammatory joint diseases*;

► In **OT conditions**: *Traumatic pain; Fibromyalgia, Myofascial pain; Tendinopathy pain (ligamentar pain); Phantom pain*

► In **Oncology**: *oncological pain*.

Authors describe different pain components and clinical elements: sensory discriminative, autonomic, motor, cognitive, emotional, etc. For the rehabilitation practice, the most important is the impact on the *quality of life (QoL)* of the patient.

2.2.PAIN MANAGEMENT – THE CLINICAL APPROACH

Pain management traditionally includes not only anti-pain therapy. The clinical rehabilitation approach requires too the diagnostic and the treatment of the reason, the source for pain.

During our modest clinical experience (of 30 years) and clinical observations and investigations on more then 2500 patients with neurological, rheumatological, orthopedical and traumatological conditions (suffering from different types of pain) we have applied different physical factors.

2.3.PHYSICAL ANALGESIA – METHODS

The application of physical modalities for pain management is called Physical analgesia. For this goal we use:

► *Preformed modalities*:

○ Low frequency currents and low frequency modulated middle frequency currents (sinusoidal-modulated, interferential, Kots currents);

○ Transcutaneous electroneurostimulation (TENS);

○ High frequency currents (*diathermy, ultra-high frequency currents, decimeter and centimeter waves*);

○ Ultra-sound and phonophoresis with NSAIDs;

○ Low frequency magnetic field;

○ Deep Oscillation;

○ LASER;

○ Extra-corporal schok wave therapy;

► *Natural modalities*:

○ Kryo-factors (*ice, cold packs, cold compresses*);

○ Thermo-agents (*hot packs, hot compresses*),

○ Hydro- and balneo-techniques (*douches, baths, piscine*);

- hydro and balneo-physiotherapy techniques (underwater massage, under water exercises, etc.);
- Peloidotherapy (*fango therapy, thermal mud, sea lye compresses*);
- Physiotherapy techniques - stretching, post-isometric relaxation, manual therapy (traction, mobilization, manipulation);
- massages (manual and with devices; periosteal, connective tissue massage, etc.);

➤ **Reflexory methods:** electrotherapy, thermotherapy and physiotherapy in reflexory points and zones; acupuncture, laserpuncture, acupressure, etc

By our opinion the anti-pain effect of physical modalities is very important, with a high level of efficacy.

Physical analgesia has not side consequences and may be applied in combination with other therapeutic factors.

2.4. PHYSICAL ANALGESIA – MECHANISMS [9, 13, 14]

In 1965 the collaboration between two individual investigators – the British physiologist **Patrick Wall** and the Canadian psychologist **Ronald Melzack**, generates the **theory of gate control**. Their common article "*Pain Mechanisms: A New Theory*", published in the journal Science in 1965, was qualified like "the most influential ever written in the field of pain". Melzack and Wall suppose the existence of a controlling mechanism in the spinal medulla, which is closed in response to the normal stimulation of fast fibers of tactile sense, but is open if the slow fibers of pain perception transport numerous and intensive sensory signals. The gate is closed if these signals are interrupted by a new stimulation of the fast fibers.

Actually, authors attempt to formulate many **theories for explanation of the pain perception** exists: **specific** theories [considering the existence of specific pain receptors - *nociceptors*]; **non-specific** [patterns theory – pain perception depends on decoding (probably at spinal level) of temporo-spatial organization of patterns – signals perceived by intensive stimulation of non-specific receptors]; and **combined** theories.

Our hypothesis [14] is an attempt to explain **pathogenetic mechanisms of physical analgesia** (figure 1):

✚ By influence on the cause for irritation of pain receptors - consequence of stimulation of circulation, metabolism and trophy of tissues (by low and medium frequency electric currents, magnetic field, ultrasound, He-Ne laser; massages; manual techniques);

✚ By blocking of nociception (low frequency currents, including transcutaneous electrical nerve stimulation or TENS; lasertherapy);

✚ By inhibition of peripheral sensitization (low and middle frequency currents, TENS; magnetic field; lasertherapy);

✚ By peripheral sympatholysis (low frequency currents like dyadinamic currents, peloids);

✚ By stopping the neural transmission (by C and Aδ delta - fibers) to the body of the first neuron of the general sensibility (iontophoresis with Novocain in the receptive zone – the region of neuro-terminals);

✚ By input of the gate-control mechanism (TENS with frequency 90-130 Hz and interferential currents with high resulting frequency - 90-150 Hz);

✚ By activation of the reflexory connections: cutaneous – visceral, subcutaneous-connective tissue-visceral, proprio-visceral, periosteal-visceral and motor-visceral (classic manual, connective tissue and periosteal massage, post-isometric relaxation and stretching-techniques);

✚ By influence on the pain-translation in the level of posterior horn of the spinal medulla – using the root of activation of encephalic blocking system in the central nervous system (increasing the peripheral afferentation) and influence on the descending systems for pain – control (TENS with frequency 2-5 Hz and interferential currents with low resulting frequency 1-5 Hz, acupuncture and laserpuncture; reflexory and periosteal massage, zonotherapy, acupressure, sudogok massage; preformed factors in reflexory zones /palms of hands, plants of feet, paravertebral points; zones of Head, of Mackenzie, of Leube-Dicke, of Vogler-Krauss/);

✚ By inhibition of central sensitization (lasertherapy; peloidotherapy; physiotherapy);

✚ By influence on the psychic state of the patient – the drug «doctor» and the drug «procedure».

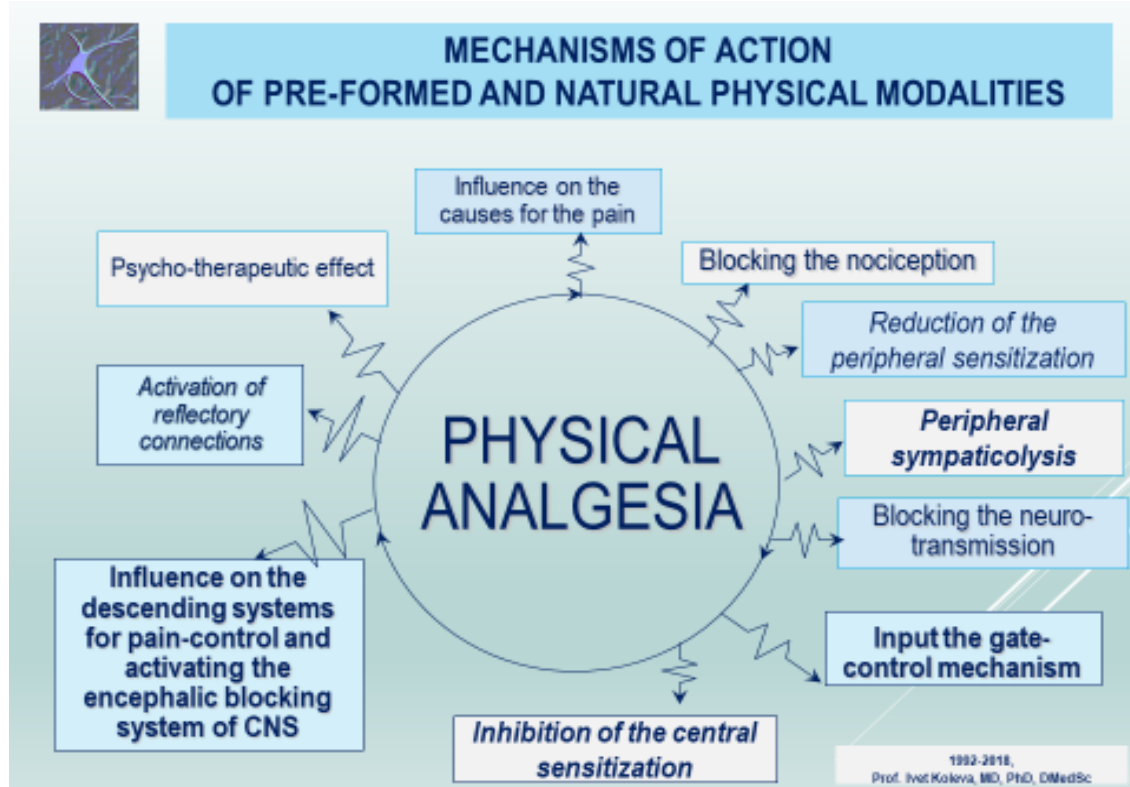


Fig. 1. Mechanisms of physical analgesia – our hypothesis

During last years, the development of the physical medicine proved the existence of some reflexory connections in the human body [14], based on the theory for the metameric structure of the embryo in the intra-uterine development. In physical analgesia we apply the following groups of reflexory connections (figure

2): *cutaneous-visceral* (zones of Head), *subcutaneous-connective tissue-visceral* (zones of Leube – Dicke), *proprio-visceral* (zones of Mackenzie), *periostal-visceral* (zones of Vogler - Krauss), and *motor-visceral* (zones of Mackenzie).

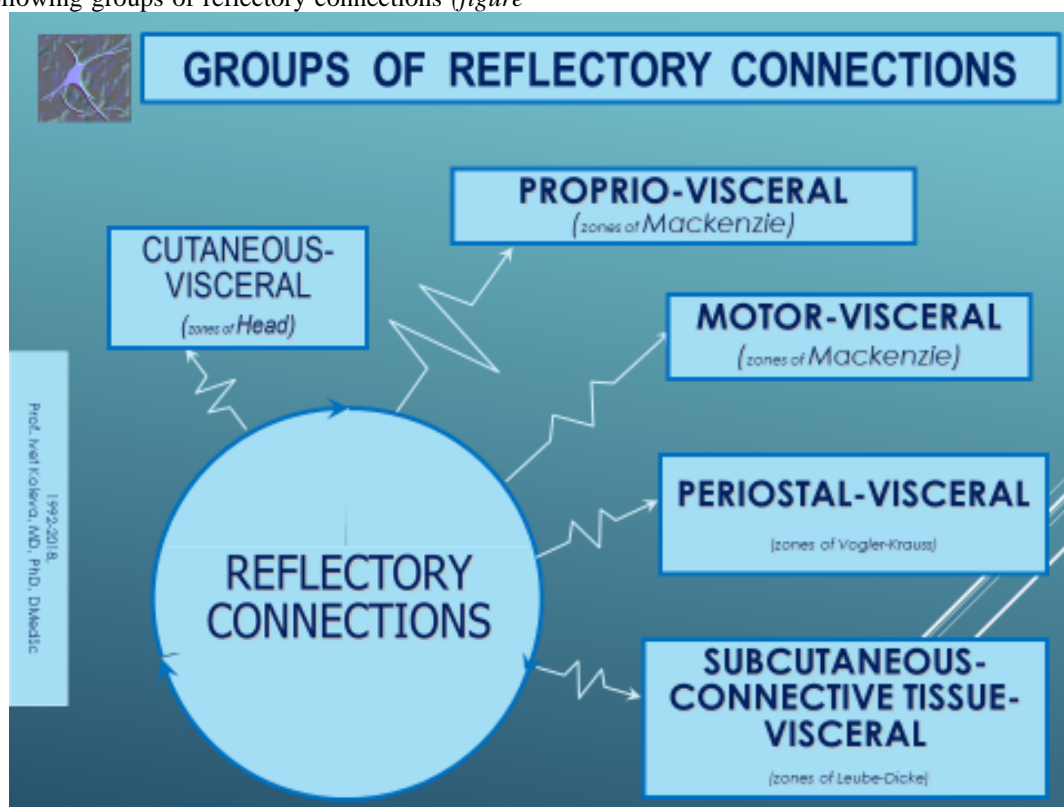


Fig. 2. Groups of reflexory connections

3. REHABILITATION PRINCIPLES

3.1. PHYSICAL AND REHABILITATION MEDICINE

According the definition of the European Union of Medical Specialists – PRM Section [46] **Physical and Rehabilitation Medicine (PRM)** is an „independent medical specialty, oriented to the promotion of physical and cognitive functioning, activities (including environment), participation (including quality of life) and changes in personal factors and environment. The specialty PRM is responsible for the management of the prevention, diagnostics, treatment and rehabilitation of patients with health-related disability and co-morbidity of all ages. According the World Report on Disability of the World Health Organization and World Bank [48] rehabilitation measures are divided into three categories: rehabilitation medicine, therapy and assistive technologies.

According the White Book on Physical and Rehabilitation Medicine [46] **the basic objective of PRM** is the optimization of social participation and the amelioration of the quality of life of patients. This includes the aid of the patient to reach possible levels and patterns of autonomy and independence, including participation in professional, social and leisure activities, part of his human rights [29, 36].

Tasks of PRM are: treatment of existing pathology; reduction of disability; prevention and therapy of complications; amelioration of functioning and activity; stimulation of patient's participation in different types of activities [33, 43, 46].

The World Report on Disability [48] defines the **goals of rehabilitation**: *prevention of the loss of*

function; slowing the rate of loss of function; improvement or restoration of function; compensation for lost function; maintenance of current function.

Modern rehabilitation has an **integrative and holistic approach to the patient**, based on the *International Classification, disability and Health (ICF)* and on clinical principles [23, 45, 47]. Current article presents the author's opinion about the necessity of structuration of complex rehabilitation algorithms (PRM programmes of care), including not only different natural and pre-formed physical modalities, but too a detailed functional evaluation at the beginning (baseline) and at the end of every rehab course – in all patients with orthopedic and traumatic conditions.

3.2. FUNCTIONAL EVALUATION

The first step of our algorithms is the **qualitative and quantitative** functional evaluation, including ICF assessment (ICF, 2001), and evaluation scales, applied commonly in the clinical practice of OT and rehabilitation [8, 10, 12, 18, 31, 35].

According ICF principles the complex functional assessment must include (figures 3, 4 & 5): *body functions* (pain, range of motion, muscle force or motor deficiency, alterations of coordination); *activities* (mobility, grasp, gait, activities of daily living /ADL/, transport); *participation* (family relationship, relaxing activities, social life, political activity); *environmental factors* (conditions of life and work, transport, family and friends, health insurance, social relationship); *personal factors* (life style, co-morbidities, age, sex) [26, 30, 32, 40].

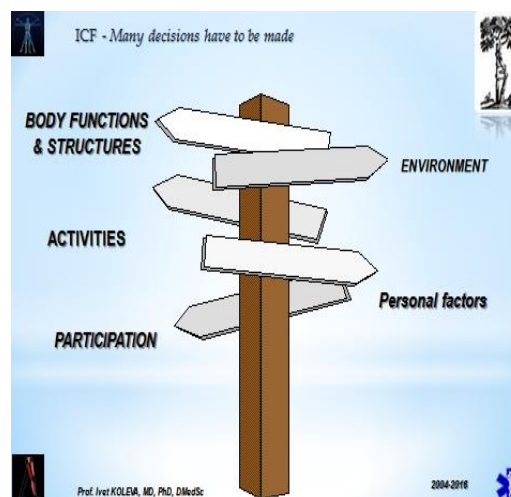


Fig. 3-4. International Classification of Functioning, disability and Health (ICF), 2001 [47]

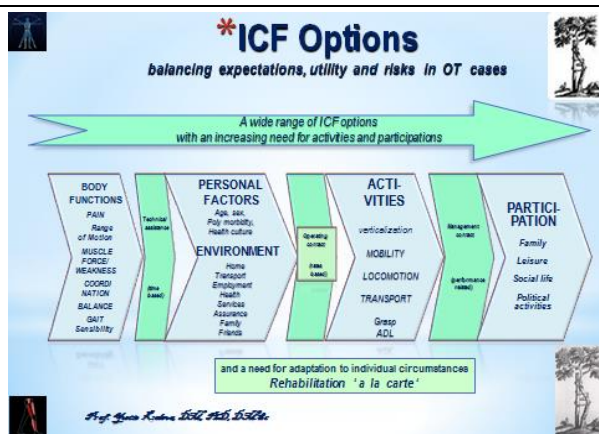


Fig.5. ICF options

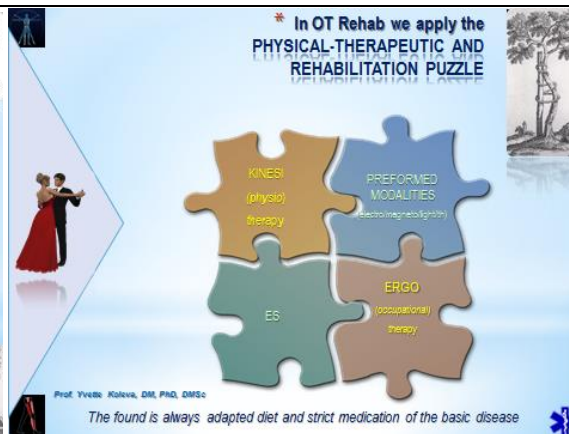


Fig. 6. Rehabilitation puzzle

During clinical assessment we accentuate on some analyses: *pain* (localization, type, intensity – verbal or visual analogue scale; modifying pain activities); *joint stability* (including joint position sense) and *range of motion* (active and passive); presence of oedema, muscle or joint *contractures*; *evaluation of the muscle force / muscle insufficiency, motor deficit; analysis of the grasp and gait; mobility* (necessity of technical aids - canes, walking sticks, crutches, walkers, wheelchairs and other devices); *fatigue* (physical endurance, necessity of rest during the examination or the functional activity); *autonomy in everyday activities* (bathing, dressing, eating, putting shoes on, personal hygiene, need of help in ADL). Evaluation of problems must be qualitative and quantitative, including: fatigue, motor deficiency, coordination problems (body position, gait, grasp); pain; conscience for the necessity of technical aids; difficulties in ADL; limitations in functional mobility [2, 8, 12, 15, 38, 40].

The control before and after rehabilitation is obligatory. At the end of every course we realize a detailed clinical, para-clinical and functional (including instrumental) revision of the obtained results, and we prescribe a periodical control and periodical PRM courses. We consider that the functional evaluation is very important not only for control of the quality of rehabilitation, but too for amelioration of independence in everyday activities and of

health-related quality of life of patients.

3.3. REHABILITATION PROGRAMME

The complexity of rehabilitation in OT cases imposes the necessity of a holistic approach to the patient – detailed functional analysis before and after the rehabilitation courses; application of therapeutic methods of different medical specialties (principally orthopedics and traumatology; neurology and neurosurgery; rheumatology; PRM) and from non-medical fields (kinesitherapy, sociology, psychology, occupational therapy). We apply basic principles of the specialty Physical and Rehabilitation medicine [8, 9, 11, 18, 23]. Depending on the results of the assessment of the rehabilitation potential of the concrete patient, we use different physical modalities and methods in different combination – the rehabilitation puzzle (figure 6). In every stage of the rehabilitation processus we must define precisely the goal, tasks and algorithms of rehabilitation. In every case our goal is to assure a high quality of the rehabilitation, optimal for the clinical form of the principal disease or condition, adapted to the age, co-morbidities, capacity and desire of the concrete patient; with the strategic goal to receive the best result for his quality of life.

The complex rehabilitation programme includes physical and drug therapy, diet, patient education (table 1).

Table 1:

Parts of the complex rehabilitation programme

KINESI- and ERGO-therapy (exercises, activities, massage, manual therapy)	PREFORMED physical modalities (electric currents, magnetic field, light, LASER, ultra-sound)	CRYO-/THERMO-/BALNEO-/PELOIDO-therapy (ice, mineral waters, therapeutic mud, paraffin)	DIET (proteins /amino-acids/, hypolipidic, hypo-glucidic)	PATIENT EDUCATION (medicaments; diet; basic physical activity; weight control)
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In our clinical practice we apply a synergic combination of two or three (2-3) procedures with preformed modalities (electro- and photo-therapy, LASER; magnetic field; ultra-sound, etc.); one or two (1-2) cryo- / hydro- / balneo- / thermo-therapeutic procedure with three or four (3-4) kinesi-therapeutic methods and one or two (1-2) ergo-therapeutic activity [3, 24, 25, 28, 37, 44]. The functional recovery depends principally from the training of grasp and gait, and the

education in activities of daily life [1, 5, 6, 7, 11, 27, 28, 34, 41]. **For the structuration of the individualized for every patient PRM programme** we used the capacities of different traditional and contemporaneous natural and pre-formed factors, accentuating on the potential of modern methods, e.g.: transcutaneous electro-neurostimulation (TENS), functional electrostimulations (FES), Lasertherapy and Laserpuncture, Deep Oscillation, schock wave therapy;

proprioceptive neuro-muscular facilitation, analytic exercises, post-isometric relaxation, stretch techniques; and ergo-therapeutic methods [5, 9, 13, 14, 39, 42].

The control after the rehabilitation course and the prescription of periodical ambulatory PRM courses are very important. We consider necessary the continuity of PRM-care: in-patients in acute care hospitals and in PRM clinics (Departments), in-patients in long-term specialized hospitals; out-patients in ambulatory medical and PRM centres; balneo-kinesitherapy in resorts.

4.CONCRETIZATION OF ALGORITHMS.

CLINICAL APPROBATION.

The presented PRM algorithm can be concretized and we used it during our own clinical investigations and observations (including clinical case studies) of rehabilitation of patients with different OT conditions: shoulder instability and rotator cuff injuries; distal radius fractures & Zudeck's algoneurodystrophy; hip replacement, partial and total knee arthroplasty, periprosthetic fractures; intertrochanteric & femur shaft fractures; after anterior and posterior cruciate ligament reconstruction; after partial and total meniscectomy; patella (knee cap) dislocation and fracture; tibial plateau and tibial plafond fractures; ankle fractures, Lisfranc and Chopart's injuries (fracture-dislocation); upper or lower limb amputation with phantom pain and prosthesis. [8, 9, 14, 15, 16, 17, 19, 39, 42].

The on-time initiation of rehabilitation procedures in OT management (especially after OT interventions) has a lot of positive consequences: amelioration of the clinical status of patients and prevention of complications; augmentation of muscle force and range of motion, pain relief, oedema reduction, regulation of the statics and equilibrium; normalization of the scapula-humeral and the pelvi-femoral rhythm; functional recovery of the grasp and the gait; amelioration of autonomy and quality of life of patients; acceleration of the resocialization and inclusion in functional activity, economic effect.

5.SUMMARY AND CONCLUSION

Pain management is an important part of rehabilitation algorithms in patients with orthopedic and traumatic conditions. We can apply many physical modalities for analgesia, adapting the algorithm to every case situation. In our clinical practice we apply systematically our structured rehabilitation algorithms, individualized and adapted to the concrete patient. We published periodically our results, proving the amelioration of the quality of life of significant number of patients (age > 18 years) with different OT conditions: orthopedic dysfunctions (scoliosis, spondylolisthesis, spina bifida, lumbalisatio S1, sacralisatio L5), traumatic injuries (incl. sports' traumas), after alloplastic surgery (hip and knee joint), after arthroscopic surgery (shoulder and knee joints), etc. In case of synergic combination of procedures we received statistically significant favorable effects on the range of motion, muscle force and muscle weakness, neuro-muscular coordination, grasp and gait, independence in ADL, quality of life of patients [1, 4, 9, 10, 14, 15, 16, 17, 19, 20, 21, 22, 39, 42].

The complex rehabilitation stimulates the functional recovery of patients in OT clinical practice, reducing their pain and ameliorating their autonomy and the health-related quality of life.

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